

Partial Oxidation for Improved Cold-Start in Alcohol-Fueled Engines

Kristine Drobot, Peter J. Loftus and Eric N. Balles
Arthur D. Little, Inc.
Cambridge, Massachusetts

*Automotive Technology Development
Customer's Coordination Meeting
Dearborn, Michigan, October 28-November 1, 1996*

Introduction

Alcohol fuels have demonstrated the potential to improve air quality relative to petroleum-derived fuels by reducing vehicle tailpipe emissions. These fuels are emerging as the preferred alternative fuel because of the superior range afforded by a liquid fuel and because they can be derived from renewable resources. However, alcohol fuels exhibit poor cold-start performance due to their low volatility. Neat alcohol engines become difficult, if not impossible, to start at temperatures close to or below freezing. Improvements in the cold-start performance (both time to start and emissions) are essential to capture the full benefits of alcohols as an alternative transportation fuel.

The objective of this on-going project is to develop a neat alcohol partial oxidation (POX) reforming technology to improve an alcohol engine's ability to start at low temperatures (down to -40°C) and to reduce its cold-start emissions. The project emphasis is on fuel grade ethanol (E95) but the technology can be easily extended to other alcohol fuels. Ultimately a compact, on-vehicle, ethanol POX reactor will be developed as a fuel system component to produce a hydrogen-rich, fuel-gas mixture for cold-start.

The POX reformer under development is an easily controllable combustion device which allows flexibility during engine startup in even the most extreme conditions. It is a small device that is mounted directly onto the engine intake manifold. The fuel-gas products (or reformat) of the POX reactor exit the chamber and enter the intake manifold, either replacing or supplementing the standard ethanol fuel consumed during an engine start. The combustion of the reformat during startup can reduce both the engine start time and the tailpipe emissions. This concept draws directly from developments made in on-going DOE-sponsored programs to develop partial oxidation reformers for mobile fuel cell applications [1] [2].

To date we have demonstrated improvements in the cold-start performance of an ethanol-fueled engine using simulated POX reformat and the operation of a prototype cold-start reformer on liquid fuel.